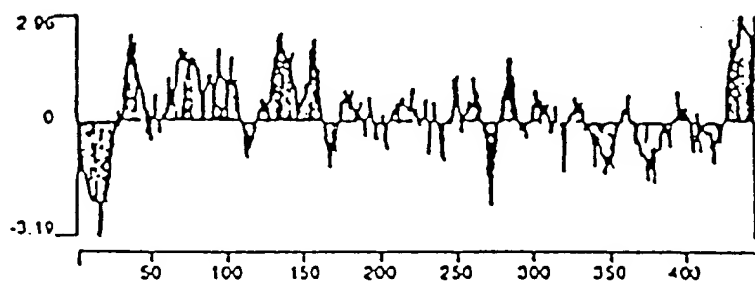


DROSOPHILA HEDGEHOG
CHICKEN HEDGEHOG-A
CHICKEN HEDGEHOG-B

1 - - - - - CHICKEN SONIC HEDGEHOG
 1 K D H H S S V P H A S A A S V T C L S L D A K C H S S S S S S S K S A A S S I DROSOPHILA HEDGEHOG
 1 - - - - - H V E H L L L T R I L L V G F I C A L L V S CHICKEN SONIC HEDGEHOG
 41 S A I P Q E E T Q T H R H I A H T Q R C L S R L T S L V A L L L I V L P H V F S DROSOPHILA HEDGEHOG
 23 S G L T C G P G R G I G K R R H P K K L T P L A Y K Q F I P H V A E K T L G A S CHICKEN SONIC HEDGEHOG
 81 F A H S C G P G R G L G R H R - A R H L Y P L V L K Q T I P H L S E Y T H S A S DROSOPHILA HEDGEHOG
 63 G R Y E C K I T R N S E R P K E L T P N Y N P D I I F K D E E N T G A D R L H T CHICKEN SONIC HEDGEHOG
 120 G P L E G V T R R D S P K F K D L V P H Y N R D I L F R D P P G T G A D R L H S DROSOPHILA HEDGEHOG
 103 Q R C K D K L H A L A I S V H N Q H P G V K L R V T E G H D E D C H H S E E S L CHICKEN SONIC HEDGEHOG
 160 K R C K E K L H V L A Y S V H N E H P G I R L L Y T E S H D E D Y H H C Q E S L DROSOPHILA HEDGEHOG
 143 H Y E G R A V D I T T S D R D R S K Y O H L A R L A V E A Q P D H V Y Y E S K A CHICKEN SONIC HEDGEHOG
 200 H Y E G R A V T I A T S D R D Q S K Y G H L A R L A V E A G P D H V S Y V S R R DROSOPHILA HEDGEHOG
 183 H I H C S V K A E H S V A A K S G Q C F P O S A T V H L E H Q O T K L V K D L S CHICKEN SONIC HEDGEHOG
 240 J L I Y G S V K S D S S I S S H V H Q C F T P E S T A L L E S G V R K P L O E L S DROSOPHILA HEDGEHOG
 223 F G D R V L A A D A D G R L L Y S D F L T F L D R H D S S R K L F Y V I E T R Q CHICKEN SONIC HEDGEHOG
 200 I G D R V L S H T A H G Q A V Y S E V I L E H D R H L E Q H Q N F V O L H T - D DROSOPHILA HEDGEHOG
 263 P R A R I L L T A A H I L F V A P Q H N Q S E A T O S T S Q Q A L F A S H V K P CHICKEN SONIC HEDGEHOG
 319 O G A V L T V T F A H L V S V H Q - - - - - P E S Q K L T F V F A D R I E E DROSOPHILA HEDGEHOG
 303 G O R V Y V L C E C G Q Q L L P A S V H S V S L R E E A S G A Y A P L T A O G T CHICKEN SONIC HEDGEHOG
 352 K H O V L V R D V E T O E L R P Q R V V K V G - S V R S K G V V A P L T R E G T DROSOPHILA HEDGEHOG
 343 I L I H R V L A S C Y A V I E E H S H A H H A F A P F R L A O G L - - - L A A - CHICKEN SONIC HEDGEHOG
 391 I V V H S V A A S C Y A V I N S Q S L A H H O L A P H R L L S T L E A H L P A K DROSOPHILA HEDGEHOG
 379 - - L C P D G A I P T A A T T T T O I H H Y S R L L Y R I G S H V L D O D A L H CHICKEN SONIC HEDGEHOG
 431 E O L H S S P K V V S S A Q Q Q H Q T H H Y A H A L Y K V K D Y V I P Q S H R H DROSOPHILA HEDGEHOG
 417 P L G H V A P A S
 471 D CHICKEN SONIC HEDGEHOG
 DROSOPHILA HEDGEHOG

FIGURE 2



HYDROMATH INDEX

FIGURE 3

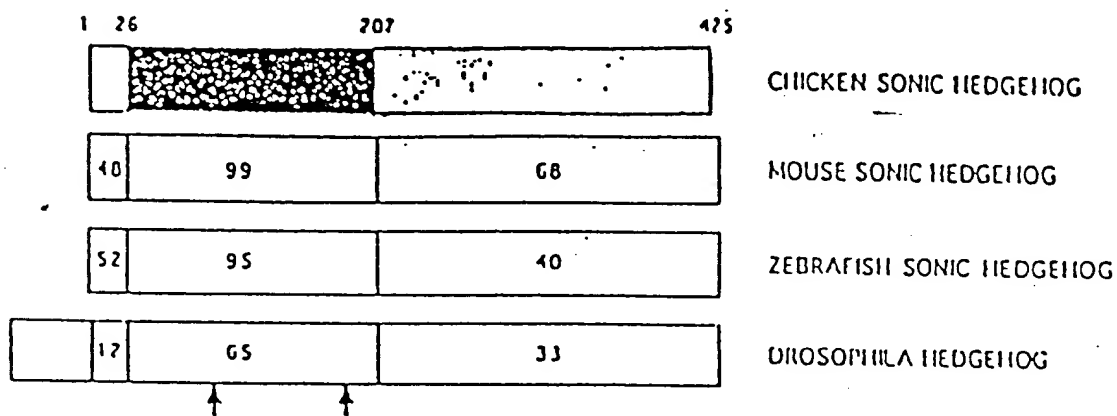


FIGURE 4

U-hh	MDNHSSVPWA	SAASVTCLSL	DAKCHSSSSS	SSSKSAASSI	SAIPOEETQT
M-Dhh	.....	.....	.....	.....	.....
M-Ihh	.....	.....	.....	.....	.....
M-Shh	.....	.....	.....	.....	.....
C-Shh	.....	.....	.....	.....	.....
Z-Shh	.....	.....	.....	.....	.....
51					
D-hh	MRHIAHTQRC	LSRLTSLVAL	LLIVLPHVFS	PAHSCGPGRG	LGRHR...AR
M-Dhh	.....	..MALPASLL	PLCCLALLAL	SAQSCGPGRG	PVGRRRYVRK
M-Ihh	.....	.....	.....	.....	.....
M-Shh	.....	MLLLLARCFL	VILASSLLVC	PGLACGPGRG	FGKRRH...PK
C-Shh	.....MV	EMLLLTRILL	VGFCALLVS	SGLTCGPGRG	IGKRRH...PK
Z-Shh	.....	..MRLLTRVLL	VSLTSLV	SGLACGPGRG	YGRRRH...PK
101					
D-hh	NLYPLVLKQT	IPNLSEYTN	ASGLEGVIR	RDSKPKDLV	PNYNRDILFR
M-Dhh	QLVPLLYKQF	VPSMPERTLG	ASCPAEGRVT	RGSERFRDLV	PNYNPDIIFK
M-Ihh	.....	.....	.....	...ERFKELT	PNYNPDIIFK
M-Shh	KLTPLAYKQF	IPNVAEKTG	ASGRYEGKIT	RNSERFKELT	PNYNPDIIFK
C-Shh	KLTPLAYKQF	IPNVAEKTG	ASGRYEGKIT	RNSERFKELT	PNYNPDIIFK
Z-Shh	KLTPLAYKQF	IPNVAEKTG	ASGRYEGKIT	RNSERFKELT	PNYNPDIIFK
151					
D-hh	DEEGTGADRL	MSKRCCKELN	VLAYSVMNEW	PGIRLLVTE	WDEDYHGGQE
M-Dhh	DEENSGADRL	MTERCKERVN	ALAIAMVNMW	PGVRLRVTE	WDEDGHHQAD
M-Ihh	DEENTGADRL	MTQRCKDRLN	SLAISVMNQW	PGVRLRVTE	RDEDGHESEE
M-Shh	DEENTGADRL	MTQRCKDKLN	ALAISVMNQW	PGVRLRVTE	WDEDGHESEE
C-Shh	DEENTGADRL	MTQRCKDKLN	ALAISVMNQW	PGVRLRVTE	WDEDGHESEE
Z-Shh	DEENTGADRL	MTQRCKDKLN	SLAISVMNQW	PGVRLRVTE	WDEDGHESEE
201					
D-hh	SLHYEGRAVT	IATSDRDSK	YGLARLAVE	AGFDWVSYS	RRHIYCSVKS
M-Dhh	SLHYEGRALD	ITTSDRDRNK	YGLARLAVE	AGFDWVYYS	RNHIHVSVKA
M-Ihh	SLHYEGRAVD	ITTSDRDRNK	YGLARLAVE	AGFDWVYYS	KAHVHCSVKS
M-Shh	SLHYEGRAVD	ITTSDRDRSK	YGLARLAVE	AGFDWVYYS	KAHIHCSVKA
C-Shh	SLHYEGRAVD	ITTSDRDRSK	YGLARLAVE	AGFDWVYYS	KAHIHCSVKA
Z-Shh	SLHYEGRAVD	ITTSDRDRSK	YGLARLAVE	AGFDWVYYS	KAHIHCSVKA
251					
D-hh	DSSISSHVHG	CFTPESTALL	ESGVRKPLGE	LSIGDRVLMS	TANGQAVYSE
M-Dhh	DNSLAVRAGG	CFPGNATVRL	RSGERKGLRE	LHRGDWVLA	DAAGRVVPTP
M-Ihh	EHSAAAKTGG	CFPAGAQVRL	ENGERSVALSA	VKPGDRVLAM	GEDGTPTFS
M-Shh	ENSVAAKSGG	CFPGSATVHL	EQCGTKLVKD	LRPGDRVLAA	DDQGRLLYSD
C-Shh	ENSVAAKSGG	CFPGSATVHL	EHGGTKLVKD	LSPGDRVLAA	DADGRLLYSD
Z-Shh	ENSVAAKSGG	CFPGSALVSL	QDGGQKAVKD	LNPGDKVLAA	DSAGNLVFS
301					
D-hh	VILFMDRNL	QMNFVQLHT	..DGGAVLTVT	PAHLVSVWQ	.....PESQ
M-Dhh	VLLPLDRDLQ	RRASFVAVET	ERPPRKLLLT	PWHLVFAAR	...GPAPAPG
M-Ihh	..VLIPLDREPN	RLRAFQVIET	QDPPRLALT	PAHLFIADN	HTE....PAA
M-Shh	FLTFLDRDEG	AKKVFYVIET	LEPRERLLT	AAHLFVAP	HNDSGPTPGP
C-Shh	FLTFLDRMDS	SRKLFYVIET	RQPRARLLT	AAHLFVAPQ	HNQSEATGST
Z-Shh	FIMPTDRDST	TRRVFYVIET	QEPVEKITLT	AAHLFVLDN	STEDLHTMT
351					
D-hh	KLTFVFADRI	EEKNOVLV..	RDVETGELRP	QRVVKVGV.SV	RSKGVVAPLT
M-Dhh	DFAPVFARRL	RAGDSVLA..	..PGGDALQP	ARVARVA.RE	EAVGVFAPLT
M-Ihh	HFRATFASHV	QPGQYVLV..	..SGVPGLOP	ARVAVS.TH	VALGSYAPLT
M-Shh	S..ALFASRV	RPGQRVYVVA	ERGDDRLLP	AAVHSVTRE	EEAGAYAPLT
C-Shh	SGQALFASNV	KPGQRVYVVG	E..GGQQLLP	ASVHSVSLRE	EASGAYAPLT
Z-Shh	...AAYASSV	RAGQKVHVVD	DSGQLKSIV	QRIYT....E	EQRGSFAPVT
401					
D-hh	REGTIVVNSV	AASCYAVINS	QSLAHWGLAP	MRLSTLEAW	LPAKEQLHSS
M-Dhh	AHGTLVNDV	LASCYAVLES	HQWAHRAFAP	LRLHALGAL	LP.....
M-Ihh	RHGTLVVEDV	VASCFAAVAD	HHLAQALFAP	LRLFPSL...	.....
M-Shh	AHGTLINRV	LASCYAVIEE	HSWAHRAFAP	FRLAHALLAA	LAPARTDGGG
C-Shh	AQGTILINRV	LASCYAVIEE	HSWAHRAFAP	FRLAQGLLAA	LCP.....
Z-Shh	AHGTLIVDRI	LASCYAVIED	QGLAHAFAP	ARLYYVSSF	LSP.....
451					
D-hh	PKVV.....	...SSAQOQN	GIHWYANALY	KVKDYVLPOS	WRHD*
M-Dhh	.....	...GGAVQPT	GMHWYSRLLY	RLAEELMG*	.....
M-Ihh	.....	..ANGSWTPE	GVHSYPOMLY	RLGRLLLEES	TFHPLGMSGA
M-Shh	GGIPAAQSA	TEARGAEPTA	GIHWYSQLLY	HIGTWLLDSE	RMHPLGMAVK
C-Shh	DGAIPTA...	.....ATTTT	GIHWYSRLLY	RIGSWVLDGD	ALHPLGMVAP
Z-Shh	KTPAVGPMRL	YNRRGSTGTP	GSC.....H	QMGTWLLDSN	MLHPLGMSVN
501					
M-Ihh	GS*	.....	.....	.....	.....
M-Shh	SS*	.....	.....	.....	.....
C-Shh	AS*	.....	.....	.....	.....
Z-Shh	SS*	.....	.....	.....	.....

FIGURE 5A

[illegible]

P N Y N P D I I F K D E E N S G A D R L M T E R C K E R V N A L A I A V M N W P G V R L R V T E G W D E D G H
 P N Y N P D I I F K D E E N T G A D R L M T Q R C K D R L N S L A I S V M N Q W P G V K L R V T E G R D E D G H
 P N Y N P D I I F K D E E N * * * * * R R L L M T Q R C K D R L N S L A I S V M N Q W P G V K L R V T E G W D E D G H
 P N Y N P D I I F K D E E N T G A D R L M T Q R C K D K L N A L A I S V M N Q W P G V K L R V T E G W D E D G H
 P N Y N P D I I F K D E E N T G A D R L M T Q R C K D K L N A L A I S V M N Q W P G V K L R V T E G W D E D G H
 P N Y N P D I I F K D E E N T G A D R L M T Q R C K D K L N A L A I S V M N Q W P G V R L R V T E G W D E D G H
 P N Y N P D I I F K D E E N T G A D R L M T Q R C K D K L N S L A I S V M N H W P G V K L R V T E G W D E D G H
 P N Y N P D I I F K D E E N X G A D R L M T X R C K X X X N X L A I S V M N X W P G V X L R V T E G X D E D G H

H A Q D S L H Y E G R A L D I T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S R N H I H V S V K A D
 H H S E E S L H Y E G R A V D I T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S K A H V H C S V K S E E
 H H S E E S L H Y E G R A V D I T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S K A H V H C S V K S E E
 H H S E E S L H Y E G R A V D I T S D R D R S K Y G M L A R L A V E A G F D W V Y Y E S K A H I H C S V K A E E
 H H S E E S L H Y E G R A V D I T S D R D R S K Y G M L A R L A V E A G F D W V Y Y E S K A H I H C S V K A E E
 H H S E E S L H Y E G R A V D I T S D R D R S K Y G M L A R L A V E A G F D W V Y Y E S K A H I H C S V K A E E
 H H F E E S L H Y E G R A V D I T S D R D K S K Y G T L S R R L A V E A G F D W V Y Y E S K A H I H C S V K A E X
 H H X X S L H Y E G R A X D I T S D R D X X K Y G X L X R R L A V E A G F D W V Y Y E S X X H X H X S V K K X X

	M-Dhh	M-Ihh	C-Shh	Zf-Shh	D-hh
M-Shh	61 (77)	63 (78)	84 (92)	68 (80)	48 (64)
M-Dhh		58 (75)	61 (77)	54 (71)	51 (68)
M-Ihh			64 (78)	61 (75)	48 (68)
C-Shh				68 (80)	49 (64)
Zf-Shh					47 (64)

FIGURE 6

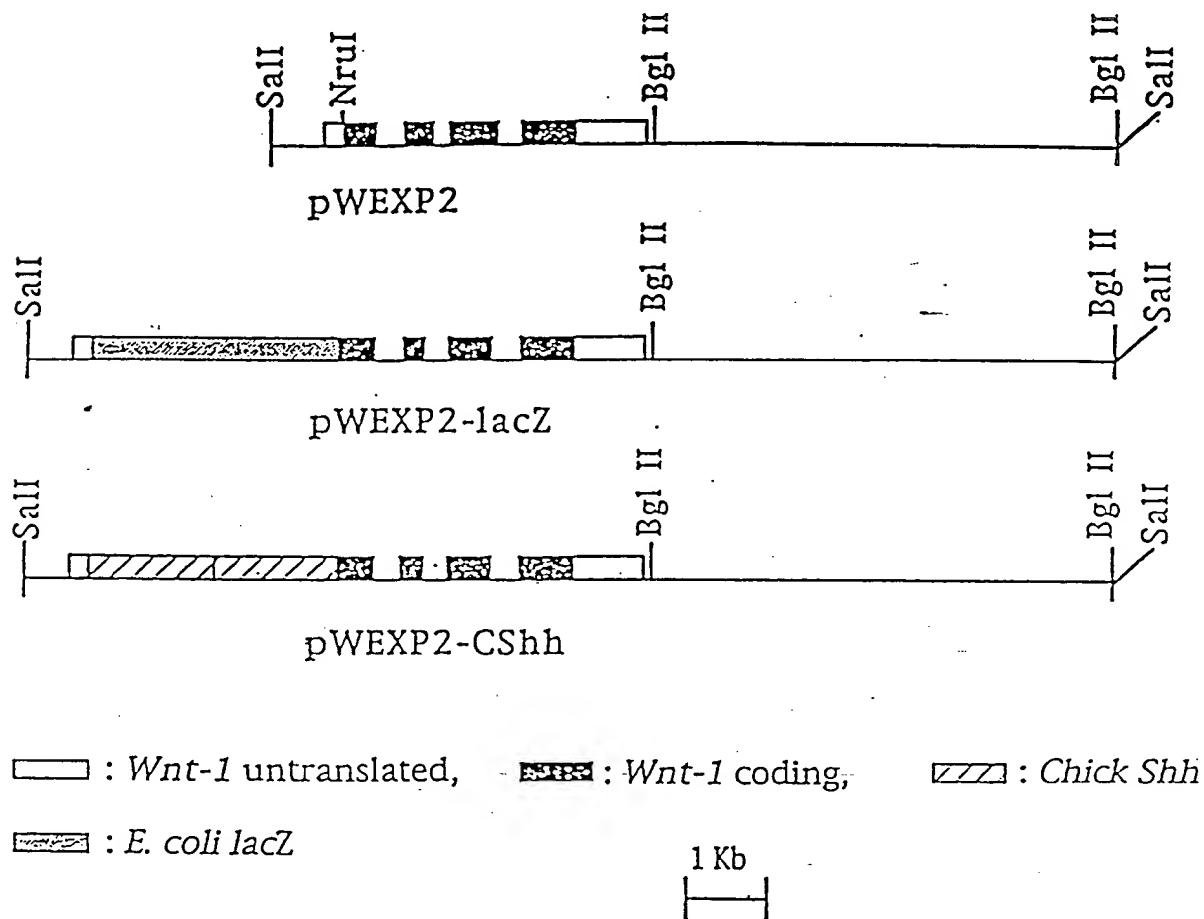
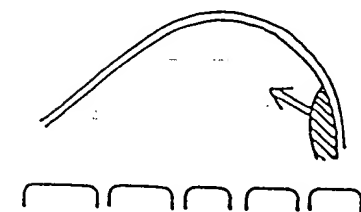


FIGURE 7

Anterior



Posterior

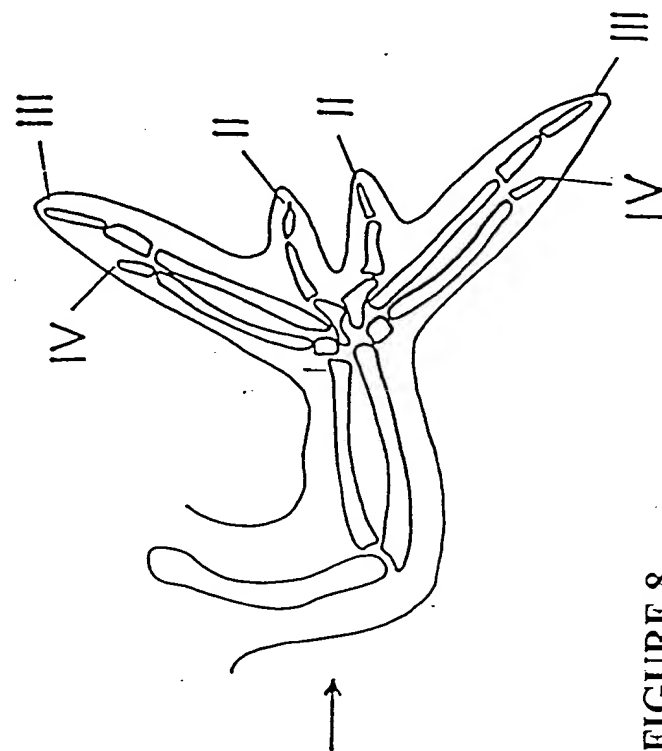
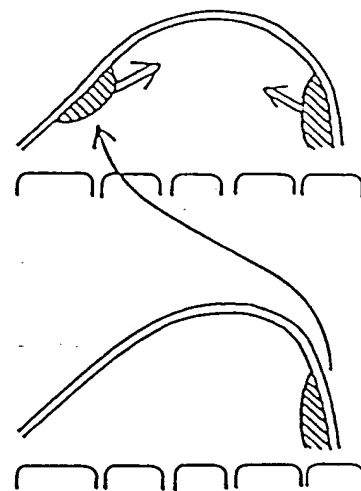
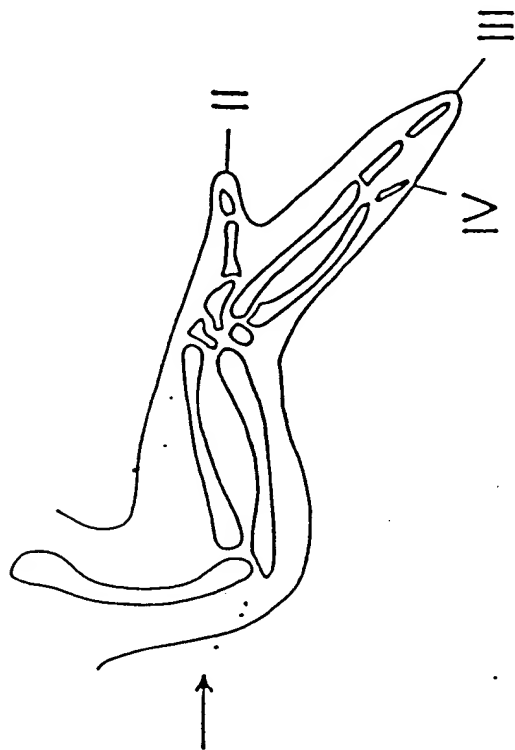


FIGURE 8

hh 1 MDNHSSVPWASAASVTCLSLDAKCHSSSSSSSSSKSAASSISAIPQEETQT

shh

hh 51 MRHIAHTQRCLSR^YLTSLVALLLVLP^YMFSPA^YHSCGPGRGLGRHR.ARN^YL
 || | | | | | | | | | |

shh 1MRL^YLTRVLLVSL^YLTSLVVS.GLACGPGRGYGRRRHPKKL

hh 100 YPLVLKQTIPNLSEYTNSASGPLEGVIRRDSPKFKDLVPNYNRDILFRDE
 || || || | | || | | | | | | | | | | |

shh 40 TPLAYKQFIPNVAEKT^YLGASGRYEGKITRNSERFKELTPNYNPDII^YFKDE

hh 150 EGTGADRLMSKRC^YKEKLNVLAYSVMNEWPGIRLVV^YTESWDEDYHHGQESL
 | | | | | | | | | | | | | | | | | | | |

shh 90 ENTGADRLMTQRCKDKLNSLAISVMNHWPGVKLRVTEGWDEDGHHFEESL

hh 200 HYEGR^YAVTIATSDRDQSKYGMLARLAVEAGFDWVS^YYVSRRIYCSVKSDS
 | | | | | | | | | | | | | | | | | | | |

shh 140 HYEGR^YAVDITTS^YDRDQSKYGTLSRLAVEAGFDWVYYESKAHIHCSVKAEN

hh 250 SISSHVHGCFTPESTALLES^YGVRKPLGELSIGDRVLSMTANGQAVYSEVI
 | | | | | | | | | | | | | | | | | | | |

shh 190 SVAAKSGGCFPGSALVSLQDGGQKAVKDLNPGDKVLAADSAGNLVFSDFI

hh 300 LFM^YDRNLEQM^YQNFVQLHT.DGGAVLT^YVT^YPAHLVSVWQPESQKL...TFVF
 | | | | | | | | | | | | | | | | | |

shh 240 MFTDRDSTTRRVFYVIETQEPVEKITLTA^YAHL^YLFVLDNSTEDLHTMTAAY

hh 347 ADRIEKNQVLVRDVETGELRPQRVVKVGSVRSKGVVAPLTREGTIVVNS
 | | | | | | | | | | | | | | | | | |

shh 290 ASSVRAGQKVMVVD.DSGQLKSVIVQRIYTEEQRGSFAPVTAHGTIVVDR

hh 397 VAASCYAVINSQSLAHWGLAPMRL^YLSTLEAWLPAKEQL.....HSS
 | | | | | | | | | | | | | | | | | |

shh 339 ILASCYAVIEDQGLAHLAFAPARLYYVSSFLSPKTPAVGPMRLYNRRGS

hh 438 PKVVSSAQ^YQNGIHWYANALYKVKDYVLPQSWRHD 471
 | | | | | | | | | |

shh 389 TGTPGSCHQMGTWLLDSNMLHPLGMSV..... 415

FIGURE 9A

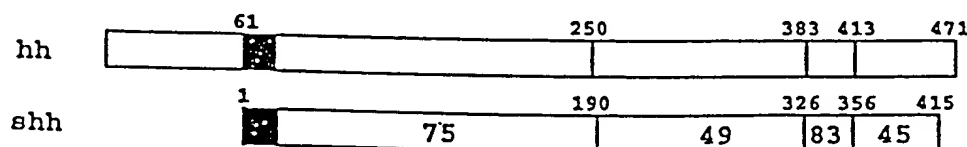


FIGURE 9B

```
hh      KRCKEKLNLVLAISMVNWPVGIRLVVTESWDEDYHHGQESLHYEGRAVTIATSDRDQSKYGMLAR  
        |||·||| || | ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| |||  
shh     QRCKDKLNSLAISMVNHWPVGKLRVTEGWDEDDGHHEESLHYEGRAVDITTSDRDQSKYGTLSR  
        ·||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| |||  
hh[a]   QRCKEKLNSLAISMVMNWPVGKLRVTEGWDEDDGNHFEEDSLHYEGRAVDITTSDRDRNKYGMFAR  
        ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| ||| |||  
hh[b]   QRCKDKLNSLAISMVNLWPVGKLRVTEGWDEDDGLHSEESLHYEGRAVDITTSDRDRNKYRMRLAR
```

FIGURE 10

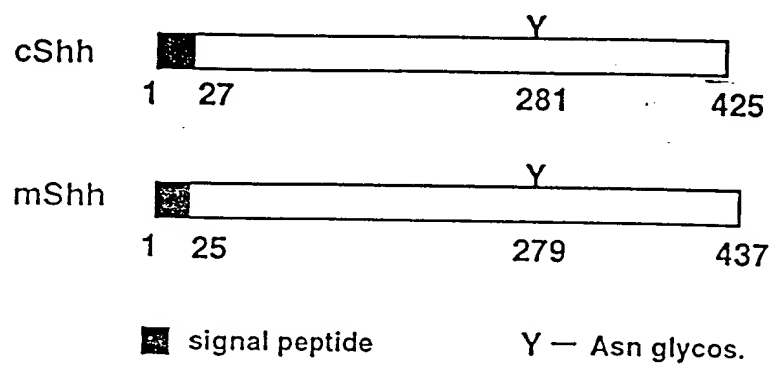


FIGURE 11

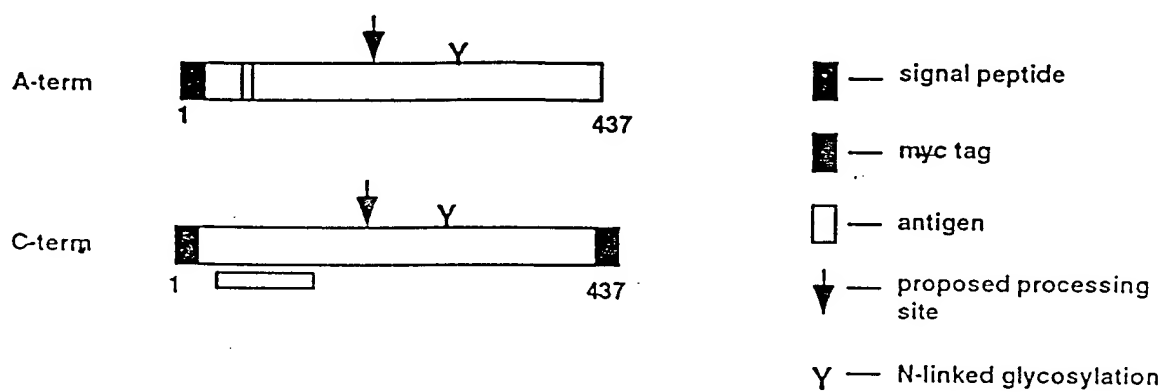


FIGURE 12

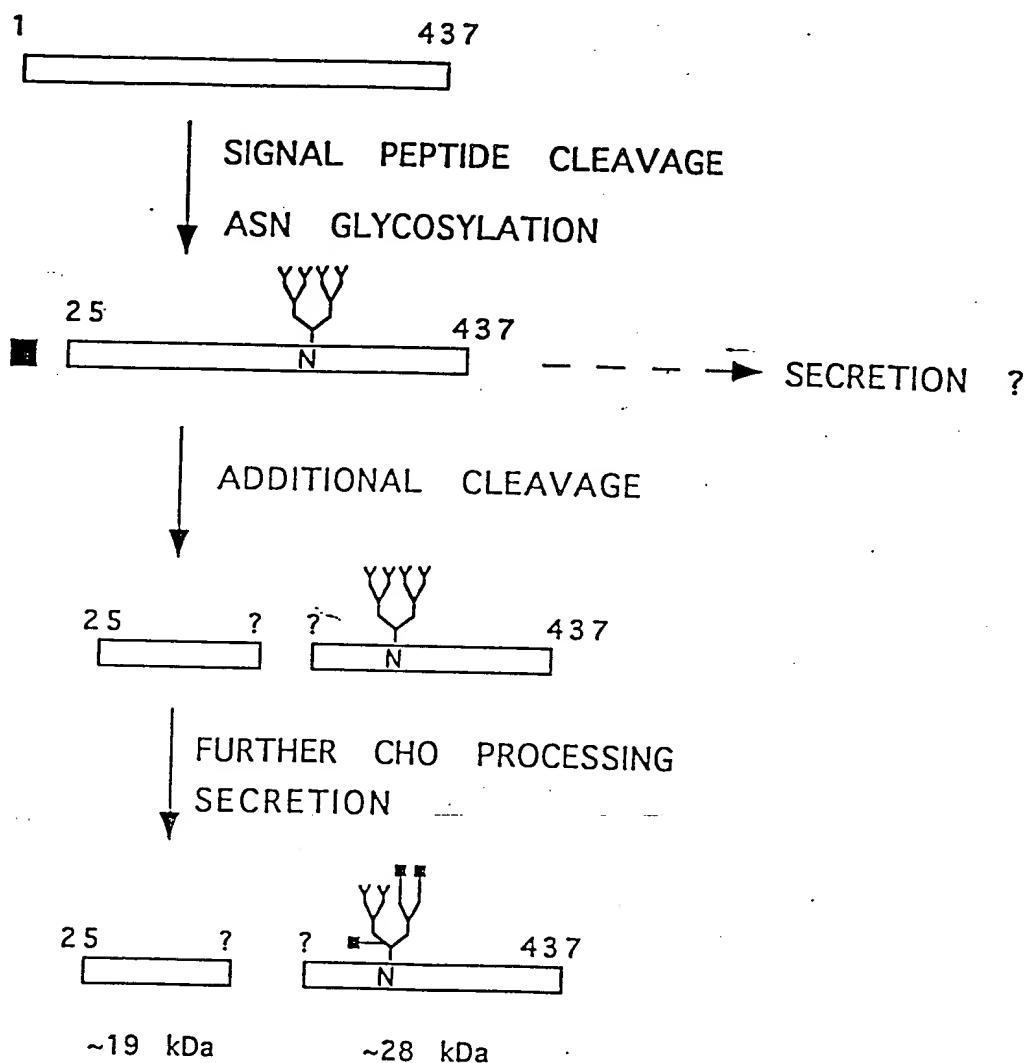


FIGURE 13

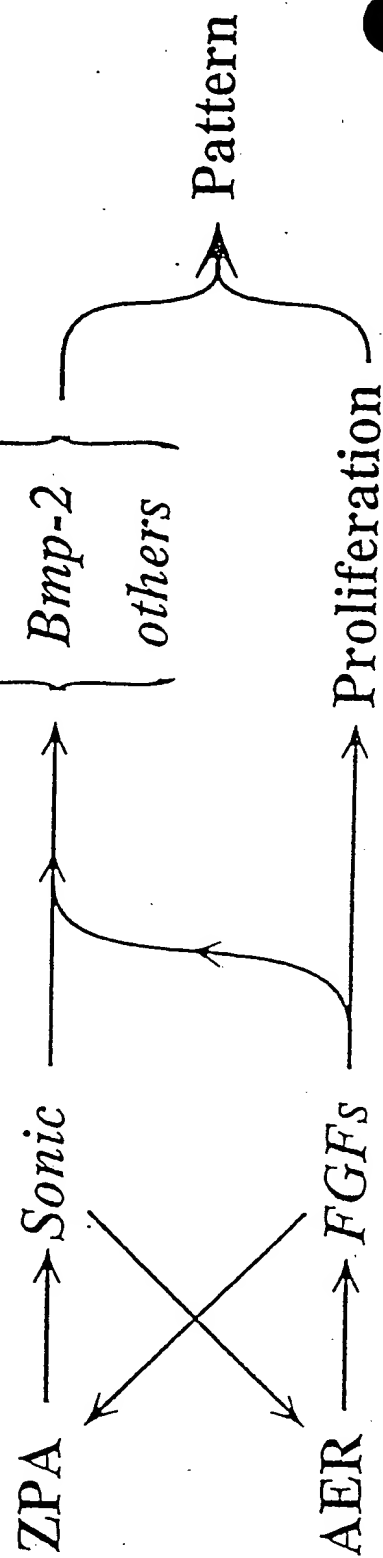


FIGURE 14

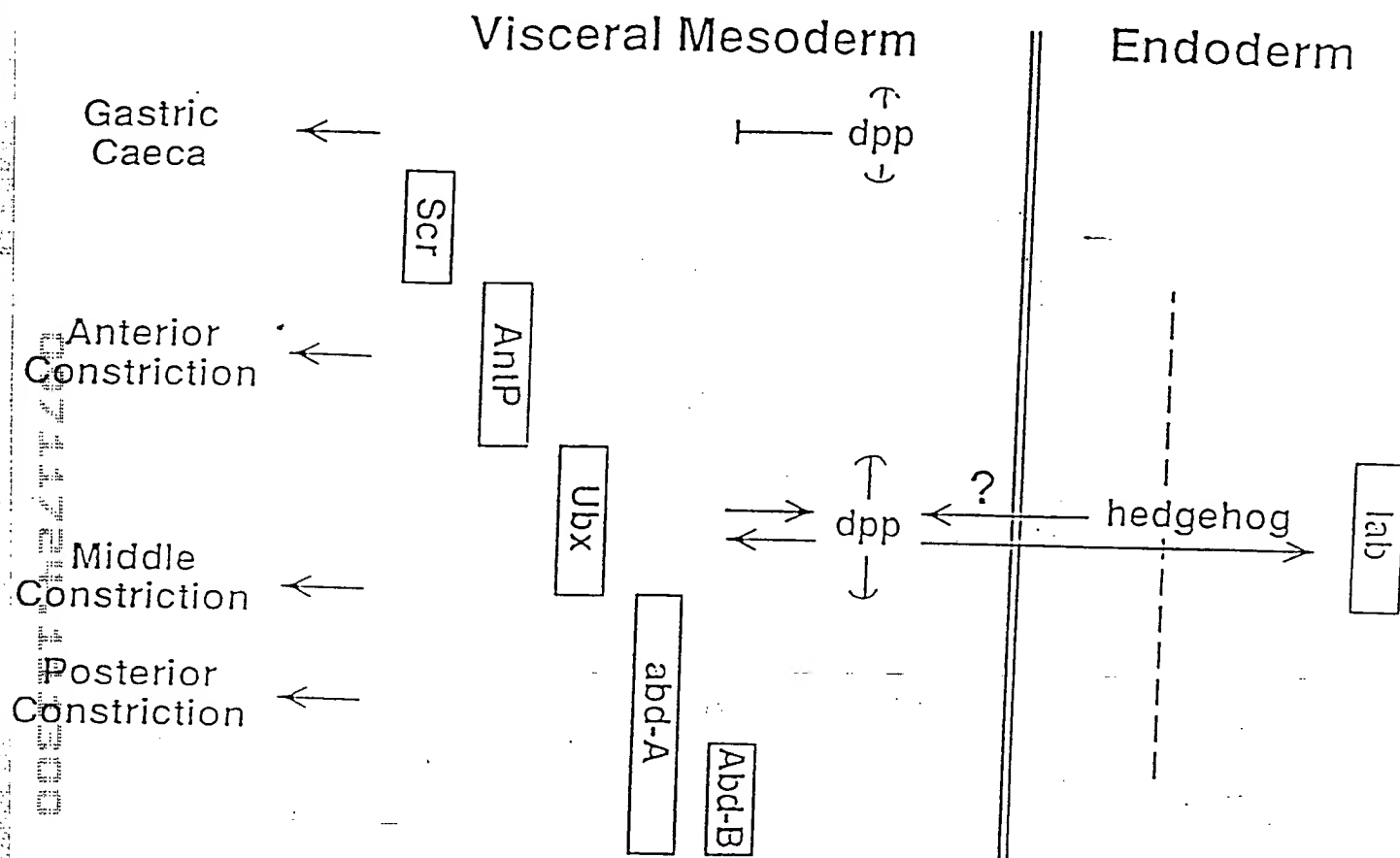


FIGURE 15A

	0	1	2	3	4	5	6	7	8	9	10
<i>Pdgfb</i>	■	■	■	■	■	■	■	■	■	■	■
<i>Gdc1</i>	■	■	■	■	■	■	■	■	■	■	■
<i>Rarg</i>	■	■	■	■	■	■	■	■	■	■	■
<i>Dna</i>	■	■	■	■	■	■	■	■	■	■	■
	0	0	0	0	0	5	14	63	30	63	30

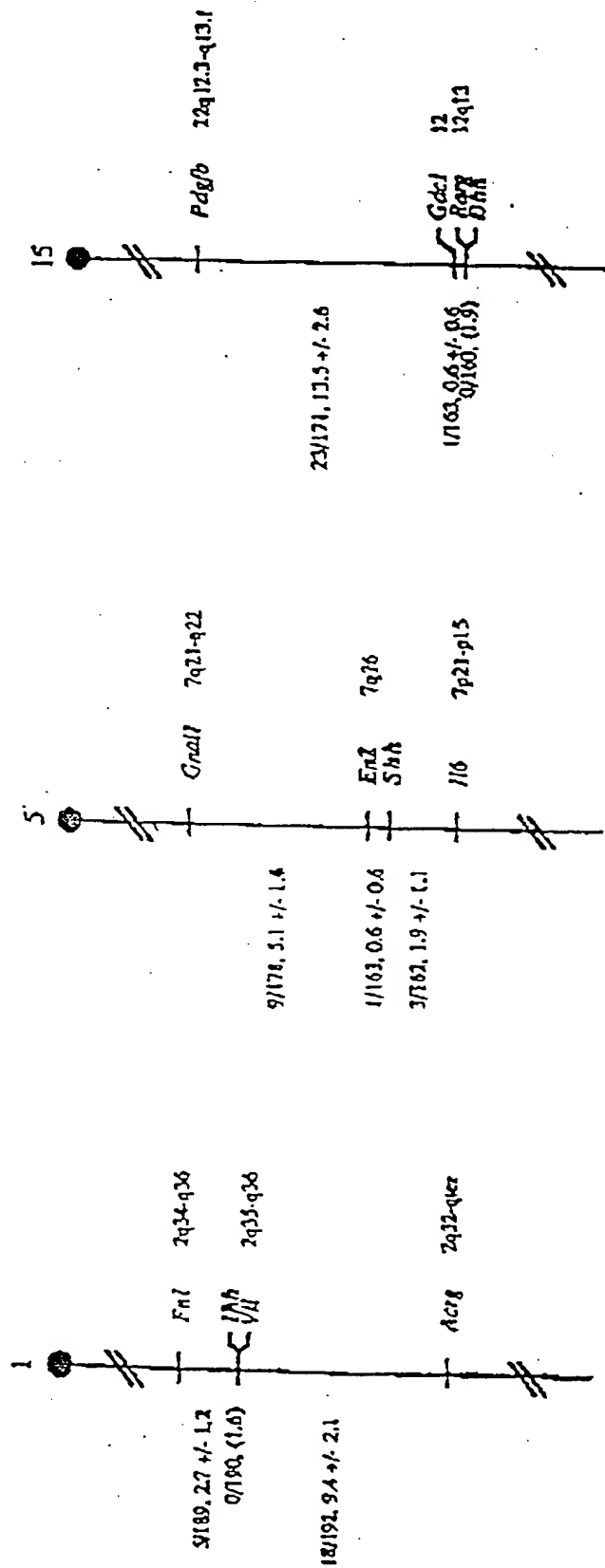


FIGURE 16

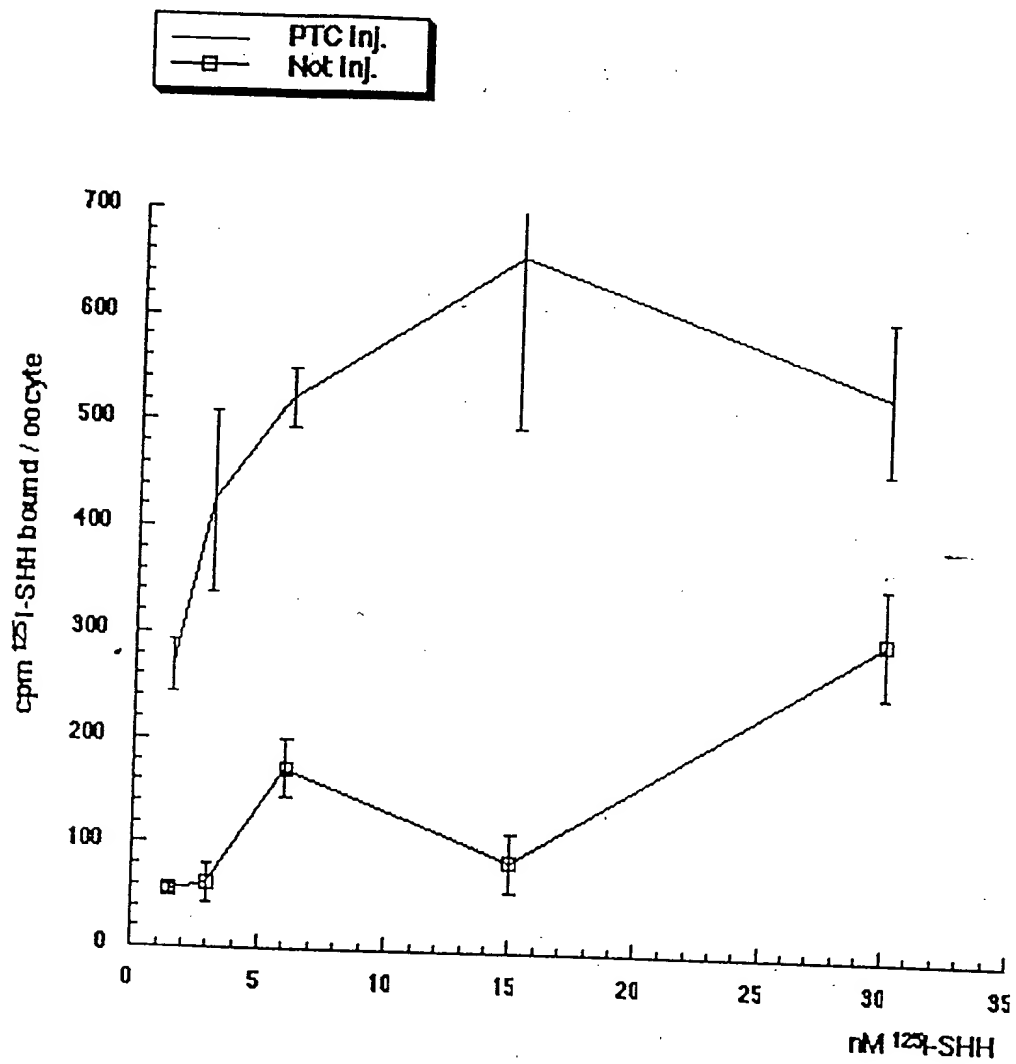


FIGURE 17

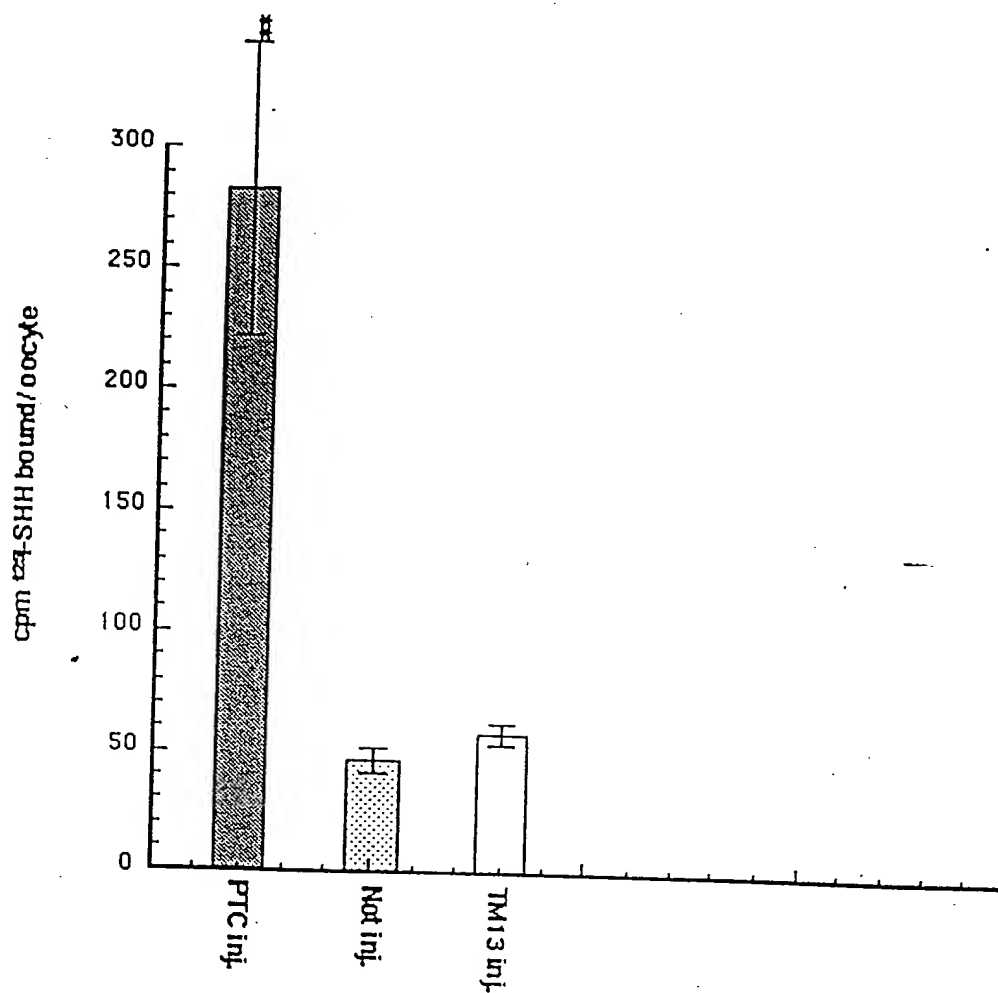


FIGURE 18

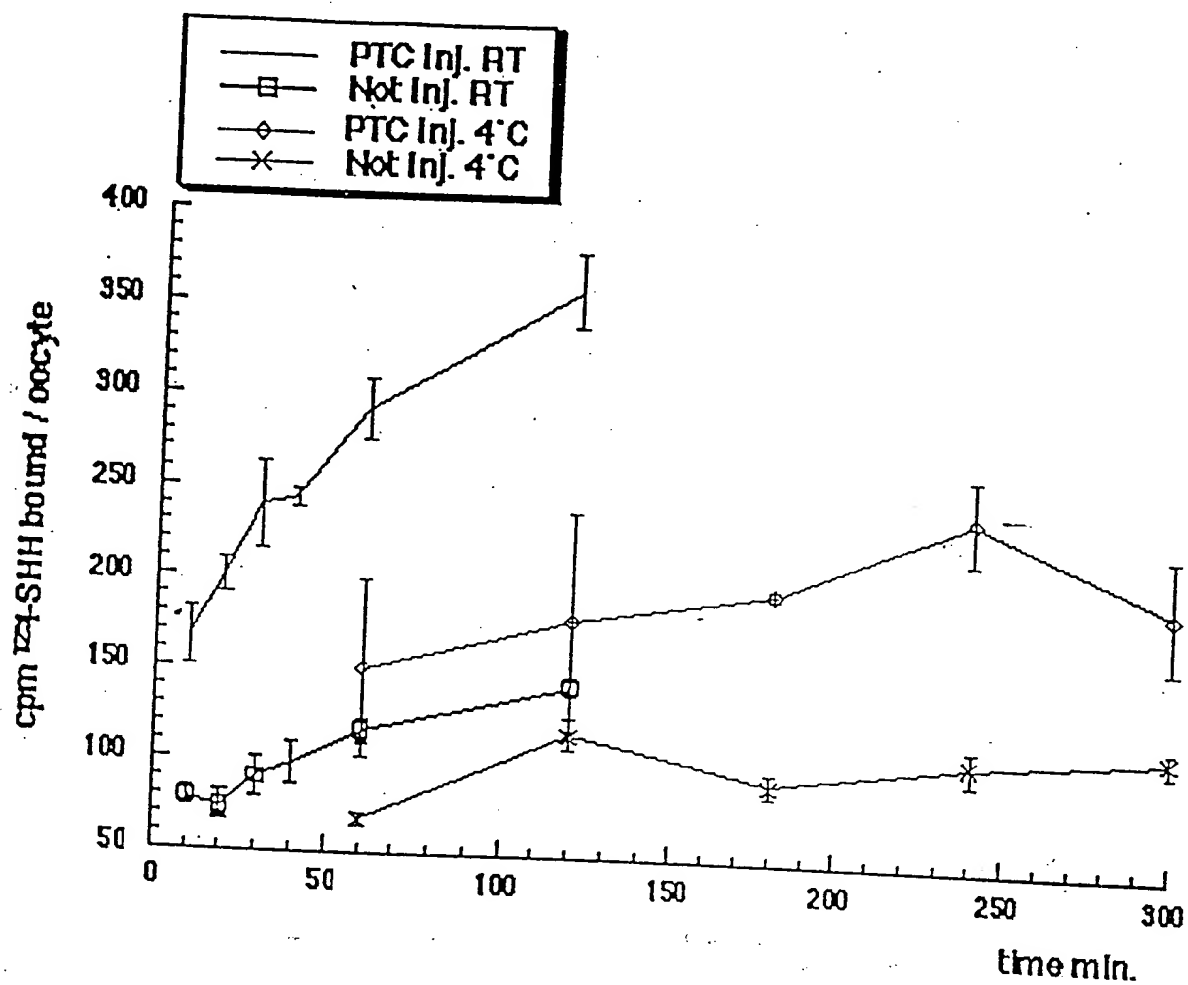


FIGURE 19

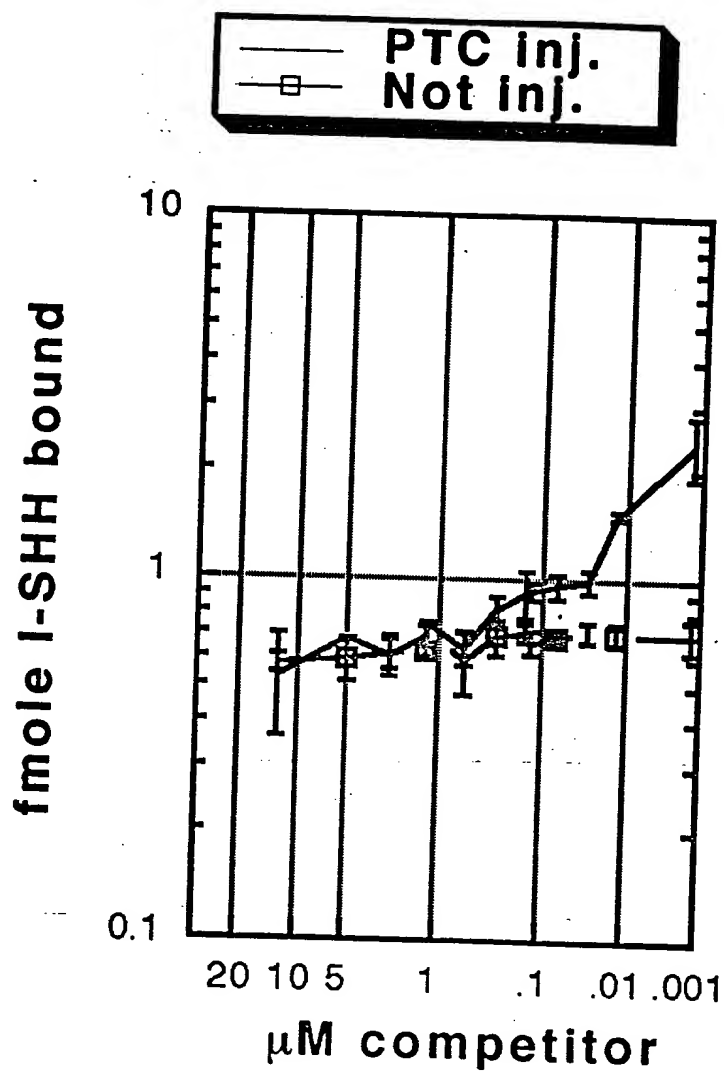


FIGURE 20

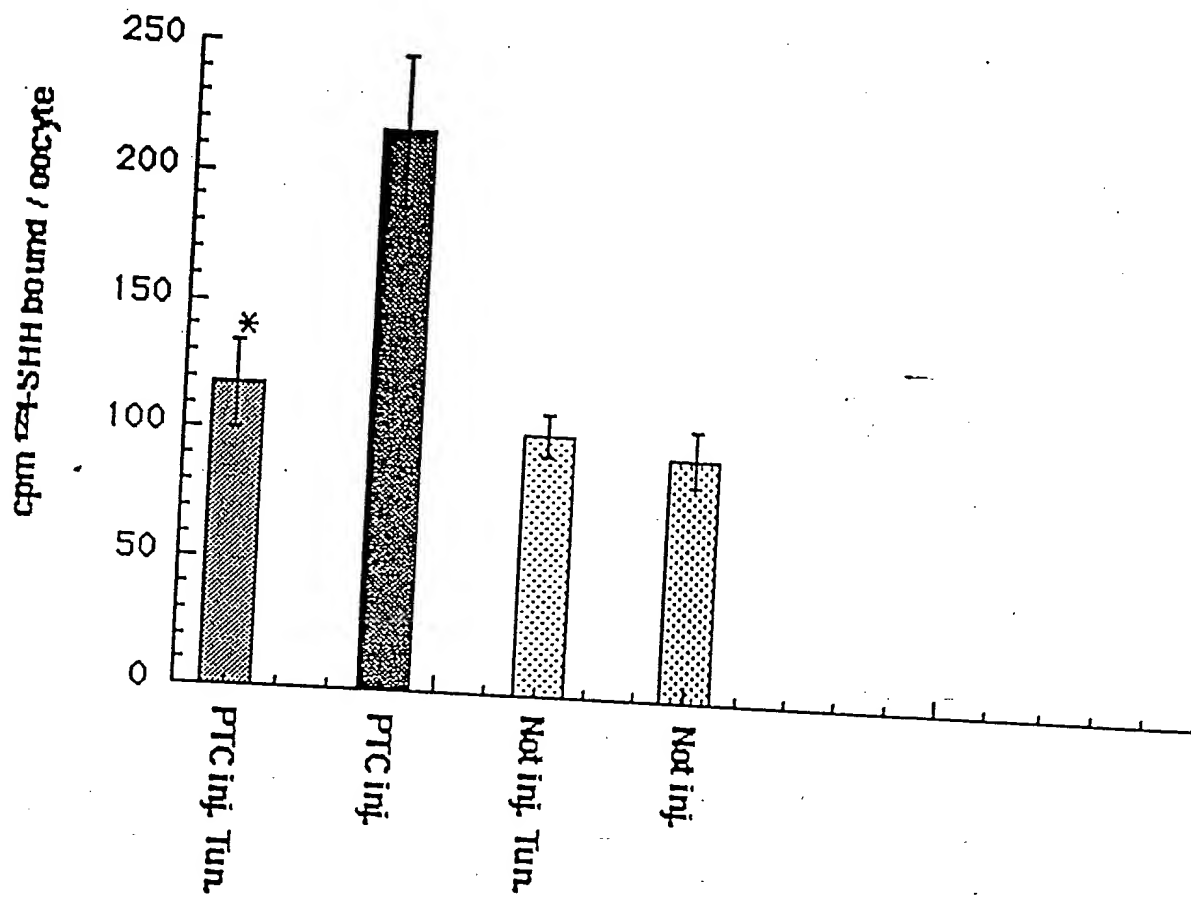


FIGURE 21

Figure 8. A possible topological model of the mouse Ptc protein. The mouse Ptc protein is proposed to have 12 TM domains and two glycosylated extracellular hydrophilic loops. Black and lightly shaded circles indicate identical and similar amino acids, respectively, shared between the mouse and fly Ptc proteins.

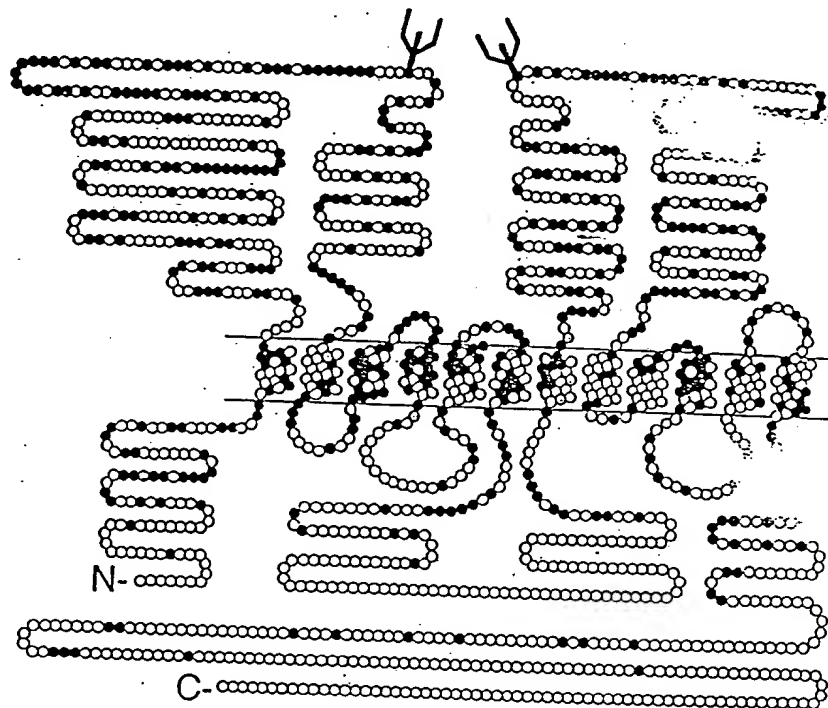


FIGURE 22